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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 85

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UDC 621.375.13

ANALYSIS AND CALCULATION OF TRANSISTORIZED MICROWAVE AMPLIFIERS WITH FEEDBACK

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 35-37
manuscript received 17 Apr 80

KLYUCHAREV, M. Yu. and SOKOL'SKIY, V. V.

[Abstract] An investigation is made of the amplifying properties of transistorized microwave amplifiers with series and parallel feedback, serving as which variable two-terminal networks are used. Theoretical relations for the maximum amplification factor are presented. Figures 2; references: 1 Russian.
[265-6415]

UDC 621.396.671

CONCERNING ERRORS OF RESTORATION OF THE DIRECTIONAL PATTERN CAUSED BY MEASUREMENT ERRORS DURING SCANNING OF THE NEAR ANTENNA FIELD

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 349-357 manuscript received 11 Sep 79

ARABADZHI, V. V., BELOV, Yu. I. and KNAFEL', A. I., Scientific-Research Radiophysics Institute

[Abstract] The authors consider the errors of determining certain characteristics of an antenna directional pattern (shift of direction of the principal maximum, the level of side lobes, half-width pattern) with respect to a criterion which is based on the concept "level intersection" for stationary fluxes, with inexact representation of the coordinates of a measuring probe. The maximum evaluations are determined for a Gaussian model of the error. In addition, the effect of the instability of the measuring system equipment on the angular distribution of the pattern error is considered for various methods of scanning of the near antenna field. The authors thank V. I. Turchin for discussion of the results. Figures 4; tables 1; references 8: 6 Russian, 2 Western (1 in translation).
[264-6415]

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION, TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

UDC 62-52 621.951.7

DESIGN OF CONTROLLERS FOR PRECISION SYSTEMS OF STABILIZATION OF OPTICAL-MECHANICAL SCANNING

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 2, Feb 81 pp 24-30 manuscript received 5 Aug 80

TIKHONOV, A. A.

[Abstract] In many devices (photoreading equipment, autocollimators, etc.), use is found for systems of stabilization of the movement of a scanning device (SD) with respect to the programming track. The SD is a body of revolution rigidly connected to the shaft of a motor. In contrast to known work in this field, the present paper considers the design of such systems with allowance made for limitation of control and the noise of measurement. Use of the theory of the space of states makes it possible to obtain a complete computation algorithm of a controller with the use of known programs. The paper was recommended by the Leningrad Institute of Precision Mechanics and Optics. Figures 1; references 2: 1 Russian, 1 Western (in translation).
[266-6415]

UDC 681.3

STRUCTURE OF PROCESSOR ELEMENTS OF RAPID FOURIER TRANSFORM PROCESSES MODULE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 2, Feb 81 pp 45-49 manuscript received 29 Dec 79

KUKHAREV, G. A., NOVOSELOV, N. D. and SKORNYAKOV, V. S.

[Abstract] It is shown that at present, during the solution of a number of problems of processing signals, more and more use is found for digital methods based on rapid Fourier transforms (RFT). The wide use of RFT algorithms in these problems is not only connected with development of new effective methods of computation on the basis of RFT, and the programs corresponding to them for general-purpose computers, but also with the creation of specialized computer devices--RFT processors. However, the principal shortcoming in known types of

RFT processors is the rigid structure of the organization. In principle this makes it impossible to perform processing of signals in the required orthogonal basis on one and the same processor, and limits use of these processors during processing of signals of various structures and with various numbers of samples, and in a number of cases does not make it possible to achieve processing of signals in on-line operation. A 1980 paper coauthored in part by Kukharev and Skornyakov, two of the authors of the present work, proposes a RFT-processor with dynamic architecture, which makes it possible to reorganize the algorithms of its functioning in accordance with the structure of the signal being processed and the orthogonal basis required. The distinctive special feature of this type RFT-processor is the modular principle of organization of its operational part. The present paper displays the algorithmic structure of the processor elements of modular RFT-processors for the cases r = 2, 3, 4, 5 and determines the overall principles of synthesis of their structure. The devices entering into the composition of the processor elements are typical, which makes it possible readily to realize them on the elemental base of contemporary large-scale integration circuits and microprocessors. The paper was recommended by the Department (Kafedra) of Computing Techniques, Leningrad Institute of Precision Mechanics and Optics. Figures 4; references 3: 2 Russian, 1 Western.
[266-6415]

UDC 681.3.04/05

RECOGNITION OF PATTERNS, INVARIANT TO THEIR DISPLACEMENT, ROTATION AND CHANGE OF STATE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 2, Feb 81 pp 41-44 manuscript received 22 Jan 80

GERASIMOV, I. L. and OCHIN, Ye. F.

[Abstract] The paper considers a procedure for evaluation of the magnitude of displacement, angle of rotation and the scale factor of a change of recognizable patterns with respect to a standard. On the basis of the evaluation obtained for the recognizable patterns it is possible to submit a procedure of normalization with respect to the parameters mentioned, after which an evaluation of the degree of proximity of the recognizable and standard patterns is trivial. The paper was recommended by the Department (Kafedra) of Computing Techniques, Leningrad Institute of Precision Mechanics and Optics. Figures 9; references 2: 1 Russian, 1 Western.
[266-6415]

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

UDC 621.396.43:621.391.827

NOISE IN TELEVISION CHANNELS OF RADIO RELAY LINES CAUSED BY RETURN DIRECTION RECEPTION

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 31-36 manuscript received 28 Apr 80

LOKSHIN, M. G., MERMEL'SHTEYN, D. V., SMANTSER, A. N. and SHCHERBAKOV, N. F.

[Abstract] The results are presented of experiments concerned with determining the noticeability of noise which develops in a television channel in the case of return direction reception, on a television image, as well as some considerations with respect to its normalization. The following are discussed: 1) Interaction of noise originating at various stations; 2) Results of experiments; 3) Interaction of noise at different levels; and 4) Comparison of subjective and objective data. According to the results of measurements conducted by a subjective-statistic expert examination, a dependence is established between a qualitative evaluation of a color television image and the signal-to-noise ratio at the input of the radio relay line receiver. Figures 6; references: 8 Russian (6 concerned with Plenary Assembly of CMTT).
[262-6415]

CERTAIN ASPECTS OF RADIOASTRONOMY, SATELLITES AND SPACE VEHICLES

UDC 538.574.6:523.164

THEORY OF DIFFRACTION AT AN OPAQUE DISK WITH A RANDOMLY UNEVEN RIM

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 2, Feb 81 pp 195-202 manuscript received 17 Jan 80

ABRAMYAN, G. L., Scientific-Research Institute of Radiophysics, Gor'kiy

[Abstract] A thin opaque disk with a randomly uneven rim is considered at a far distance from a point source of radiation. The formation of a Poisson spot behind this disk is analyzed according to the theory of diffraction at small angles, assuming a normal distribution of the height of aspertities around the rim. The mean field intensity in the spot and the power distribution over the spot are calculated in the Kirchhoff approximation. The problem is equivalent to the radiation pattern of a ring antenna with fluctuating excitation currents at its surface. The results are applicable to an analysis of the Poisson spot behind the moon produced by radiation from compact cosmic sources at wavelengths over 500 m, an angular resolution of 0.5' being attainable here. The author thanks N. G. Denisov for assistance. Figures 2; references 10: 5 Russian, 5 Western (two in translation).
[261-2415]

UDC 621.396.94

STAGGERED OBSERVATIONS OF FREQUENCY AND PHASE FLUCTUATIONS IN RADIO WAVES SCATTERED BY THE NEAR-SOLAR PLASMA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 311-318 manuscript received 18 Jan 80

YEFIMOV, A. I., YAKOVLEV, O. I., SHTRYKOV, V. K., ROGAL'SKIY, V. I. and TIKHONOV, V. F.

[Abstract] Staggered observations from two points have been very helpful in studies of interplanetary and near-solar plasmas by methods of radio astronomy. However, the usefulness of such observations is limited in two ways: firstly the distance between the two observation points must be sufficiently small to

ensure a reliable correlation between fluctuations at those points, and secondly amplitude fluctuations tend to saturate at a certain threshold intensity of inhomogeneities along the path of radio waves. Frequency and phase fluctuations during such an observation process are analyzed, their respective cross-correlation functions are found, and the results are applied to an interpretation of experimental data from "Venera-10" and Viking" missions on the motion of plasma inhomogeneities (solar wind). Figures 5; tables 1; references 17: 8 Russian, 9 Western.
[260-2415]

UDC 621.396.946

REVERSE PROBLEM OF RADIO PROBING THE VENUS IONOSPHERE FOR AMPLITUDE DATA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 319-325
manuscript received 29 Feb 80

KALASHNIKOV, I. E., MATYUGOV, S. S., YAKOVLEV, O. I., and YAKOVLEVA, G. D.

[Abstract] The reverse problem of radio probing for amplitude data is considered in connection with space explorations. A method of solving this problem is outlined and its application is demonstrated on the results of missions to the Venus ionosphere. The analysis of the problem is based on refraction and attenuation of radio waves in a spherically symmetrical medium, in a system of coordinates with the origin at the center of a given planet in the earth-satellite-planet plane. Expressions are derived for the time derivative of the refraction angle, an exact expression and a simpler approximate one, and for the refractive index. The logarithm of the latter, obtained by an Abel transformation, is proportional to the integral of the refraction angle with respect to a distance coordinate. The refractive index is also proportional to the wavelength squared and the electron concentration in the ionosphere. An evaluation of experimental data on this basis involves numerical integration, which can be done by the method of rational extrapolation and the Runge-Kutta method. An application of this procedure to experimental data from "Mariner-5" and "Venera-9, 10" missions has yielded the elevation profile of electron concentration in the nocturnal ionosphere of Venus. The authors thank N. A. Savich for his comments and discussion. Figures 3; tables 1; references 14: 10 Russian, 4 Western.
[260-2415]

UDC 681.782.44

DISPERSION INTERFEROMETERS WITH SPATIALLY STAGGERED RADIATORS AND RECEIVERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 305-310
manuscript received 13 Jul 79

SAVICH, N. A., VASIL'YEV, M. B. and GAVRIK, A. L.

[Abstract] A variation is described of a 2-frequency dispersion interferometer for remote probing of cosmic plasmas which consists of two separate radiators (space probes) and two separate receivers (ground stations). The space probes, such as "Venera-9" and "Venera-10", are assumed to carry automatic transmitters of coherent signals in interplanetary space. In the simplest situation all four points lie in one plane, i. e., the elliptic. The motion of a plasma cluster in that interplanetary space, characterized by its velocity (solar wind) and its position in the heliocentric system of coordinates, can be tracked from these four points by measurement of changes in the integral electron concentration along two paths and by determination of the corresponding time intervals from the measurement correlation function. Calculations involve triangulation with the aid of available ballistic data. Figures 3; references 6: 4 Russian, 1 Western (in translation), 1 Czech.
[260-2415]

COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

UDC 621-391

SEARCH IN COMMUNICATION SYSTEMS FOR NOISE-LIKE SIGNALS IN TIME AND FREQUENCY

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 44-47 manuscript received 27 Mar 80

VARAKIN, L. Ye.

[Abstract] In order to receive information in communication systems with noise-like signals (NLS) it is necessary at the beginning of activity to place the NLS receiver in synchronism with the information which is received, both in time and in frequency. Usually, the process of placing the NLS receiver in synchronism is called NLS search. The process of NLS search in communication systems differs from NLS search in other radio engineering systems because ordinarily the time allocated to search is small. NLS search can not occupy a prolonged time, because otherwise the information being transmitted will "age" or there simply will not be enough time for its reception. The requirements imposed on NLS search by earth satellite communication systems, start-stop systems and some others are particularly rigorous. The present paper discusses the following: 1) Process of NLS search with respect to time and frequency; 2) Average probability of error and signal-to-noise ratio; 3) Time for NLS search with complete coherent processing; and 4) Time of search with partial coherent processing. The pressing problem of the choice of the structure and the parameters of a receiving device for a discrete composite frequency signal with phase-shift keying is solved. The solution makes it possible to simplify the circuit realization of the device with simultaneous reduction of the signal search time. Figures 4; references 11: 9 Russian, 2 Western (in translation).
[262-6415]

UDC 621.396.96:621.391.26

STATISTICAL CHARACTERISTICS OF MULTICHANNEL DEVICES SEARCHING FOR COMPLEX SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 60-64
manuscript received 25 Dec 79

PETROVICH, N. T. and TEREKHOV, B. D.

[Abstract] It is known that in a search for complex signals it is advisable to make use of T-channel devices, which make it possible to obtain high noise immunity and to reduce search time at the cost of complication of the realization of search devices. Consequently, it is of current interest to determine the statistical characteristics of the operation of a search device with an arbitrary number of channels. In the present paper, expressions are obtained by the method of characteristic functions for the mathematical expectation, dispersion and the law for distribution of the time of search for a signal by such a device. Figures 4; references: 4 Russian.
[265-6415]

UDC 621.391.2

RAPID RANK ALGORITHMS FOR PROCESSING SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 71-73
manuscript received 28 Feb 80

TSURIKOV, V. M.

[Abstract] The author considers rapid algorithms for calculation of ranks during detection and reception of signals. On the basis of sorting theory, it is possible to find an array of methods for accelerated ranking of large masses of numbers, the most interesting of which are considered. Three methods of rapid ranking are studied: tournament, digital and the method of computation of addresses. They are made possible by a reduction of the operation of ranking to the sorting of random numbers in a special region. It is concluded that for computation of ranks the most suitable is the tournament algorithm which does not require knowledge of the structure and distribution of the elements of the input sample, which is characteristic for areas where use of rank methods is justified. Digital ranking is advantageous with large amounts of samples if there is the possibility of a simple expansion of the numerical codes of the elements to a small number of digits. Ranking by computation of addresses is efficient for a small number of elements, when direct use of the codes of elements as addresses is allowed. For large volumes of selections and limited memory the algorithm is effective only in the case of uniform distribution of the sample. However, a rapid reduction of cost and the dimensions of the memory elements gives a reason to assume that the method in question is very promising.

Thus, reduction of the operation of ranking to sorting of data in a special S-region of the memory makes it possible to develop a series of rapid algorithms for computing ranks, which makes possible construction of rank detectors and receivers of signals in real time. In contrast to known methods of accelerating computation of rank statistics, the algorithm in question do not reduce the effectiveness of statistics. Figures 1; tables 2; references 6: 1 Russian; 5 Western (3 in translation).
[265-6415]

UDC 621.391.2:519.2

EFFECT OF POWER FLUCTUATIONS ON THE QUALITY OF DISCRIMINATION OF STOCHASTIC SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 68-71
manuscript received after completion 7 Aug 80

GUSEV, A. V. and KISELEV, A. Z.

[Abstract] During detection and classification of the signals of fluctuating objects, an investigation of the structure of a disturbed sea surface by reflected radar signals, and in a number of other problems, the necessity appears for discrimination of random time functions, the statistical parameters of which in turn are random. A suitable operating model of such signals is a model of a Gaussian random process, the parameters of which are random magnitudes. During this the resulting random signal is no longer Gaussian and determination of the probability characteristics of the quality of discrimination (classification, detection) of such signals is complex and with frequently insoluble mathematical problems. On the basis of a numerical calculation, the present paper gives an evaluation of the effect of power fluctuations of conditionally Gaussian stationary processes on the quality of their discrimination. Figures 2; references: 1 Russian.
[265-6415]

UDC 621.391.2:621.391.63

QUASI-OPTIMUM ALGORITHM OF SIGNAL FLUX DETECTION

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 2, Feb 81 pp 188-194 manuscript received 6 Dec 79

LEVSHIN, V. P. and CHEKUROV, G. I.

[Abstract] Known quasi-optimum algorithms of detection of fluctuating pulse signal fluxes are either of the "l out of L" type or of the "linear integrator (summation of readings)" type, both efficient only for an a priori fixed number

of signals in the flux. The authors propose an algorithm intermediate between those two which will also be efficient when the number of signals in the flux varies over a wide range. The assumptions are: the signal flux is processed with a matched filter and an envelope detector; its energy is uniformly distributed over k resolution intervals containing an additive mixture of signal and noise; this mixture as well as the noise alone are statistically independent with a Rayleigh distribution and are stationary within each resolution interval; individual signals have been resolved which appear equiprobably in any k of L tested resolution intervals. Their number k in the flux is random and with a given probability is equal to one of L values in the natural series. Weak signals are to be detected as the signal-to-noise ratio tends to zero. The quasi-optimum detection rule, involving a weighted summation, is obtained from the optimum one by replacing one sum in the maximum-likelihood ratio with its largest term. The detection characteristics (false-alarm probability), calculated approximately with the aid of Laguerre polynomials replacing the Z-distribution, indicate that this new algorithm is simpler and more energy efficient than the other two. Figures 2; references 5: 4 Russian, 1 Western (in translation).
[261-2415]

UDC 621.391.019.4

METHOD OF PROCESSING OF COMPLEX SIGNALS ON A BACKGROUND OF STRUCTURAL NOISE

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 52-55
manuscript received 27 Oct 80

DRUZHININ, V. V.

[Abstract] In contemporary radio engineering systems detection and discrimination of signals is conducted on a background of structural noise, i. e., noise corresponding with respect to structure with the legitimate signal. An asynchronous address system, for example, with code multiplexing and separation of subscriber signals operates under such conditions. Its subscribers transmit information by complex signals which can be divided at the receiving side with a complete overlap of them with respect to frequency and time. However, the absence of orthogonality between the subscriber signals leads to the presence of structural noise. In the present paper a system of phase-shift keying of signals is selected as a subscriber signal, and the case is considered of the effect on the legitimate signal of an interfering signal--structural noise. A receiver is proposed which makes it possible to accomplish not only rejection but also partial intercompensation of the elements of an interfering signal. A block diagram of the receiver is explained, and its noise immunity is analyzed. Figures 3; references: 2 Russian.
[265-6415]

UDC 623.4.021:621.391.27

GAME-THEORETIC EVALUATION OF THE EFFECTIVENESS OF OPTIMIZATION OF THE FORM OF SIGNALS WITH SUCCESSIVE FILTRATION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 64-65
manuscript received 1 July 80

MARIGODOV, V. K.

[Abstract] Using game theory, the effectiveness is evaluated of the optimization of the form of a signal with successive filtration. Ordinarily, for optimization of the form of signals in information transmission systems, a linear shaping filter is connected to the transmitting side, and on the receiving side preceding the computing circuit a correcting filter is placed, which fulfills the role of an optimum linear filter. If it is assumed that between the operator of the system of information transmission and the operator of the system of radio interference or "nature" there is a conflict situation, then for an evaluation of the effectiveness of the method it is possible to use a game-theoretic approach. In those cases when the conflict situation is taken by convention, it is possible to evaluate the potential effectiveness of the method. A block diagram of the use of the method is presented in the present paper and it is explained. With the aid of the apparatus of game theory, the effectiveness is evaluated of the optimization of the form of a signal with successive filtration. Parameters are found for the case when the amplitude-frequency characteristics of the shaping and optimum linear filters are not reciprocal. As the result of the game--theoretic approach with statement of the problem in normal form, the pure minimax strategies of the sides and the cost of the games are determined. The strategy of the operator of the system of information transmission depends on the spectra of the signal and the additive interference, and the strategy of the operator of the system of radio interference depends on the spectrum of the signal, the nature of the weighing and the amplitude-frequency characteristics of the shaping filter. Use of game methods made it possible to obtain the results of an evaluation which it is impossible to obtain in such a visible form by the use of a known energy criterion. The latter confirms the methodological advisability of the solution of minimax problems of evaluation of the effectiveness of systems of information transmission in situations of game arrangement. Figures 1; references 5: 3 Russian, 2 Western.
[265-6415]

UDC 621.391.24

MOMENTS OF THE CORRELATION FUNCTION DISTRIBUTION FOR LINEAR SYSTEMS WITH PHASE SHIFT KEYING OF SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 334-338
manuscript received 20 Dec 79

SAL'NIKOV, Yu. K. and VARAKIN, L. Ye.

[Abstract] A linear system of phase shift keying signals is defined as a set of N long 1,-1 code sequences with a volume $L = 2^k$ ($k = 1,N$) satisfying all axioms of a group. The correlation properties of such systems are most thoroughly described by the distribution of values of their correlation functions. Accordingly, the authors derive a general expression for any p-th moment of this distribution. A relation is also established between any p-th moment of this distribution and the basis code sequence so that the latter will thus fully determine the characteristics of such a linear system. As an example, the complete code (linear system) is given in the form of an $N \times N$ matrix of basis code sequences, and the p-th moment of the corresponding correlation function distribution is calculated from the number of all combinations of p columns whose symbol product equals a unitary column. A special case is the Walsh subgroup with $N = 2^n$ and $L = N$. Because the number of basis code sequences increases only logarithmically with increasing volume, in a typical volume $L = 1024$ it is sufficient to analyze only $k = 10$ code sequences. References 5: 4 Russian, 1 Western.
[260-2415]

UDC 681.335.2

NOMOGRAM FOR DETERMINATION OF THE PARAMETERS OF AN ANALOG-DIGITAL CONVERSION OF SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 89-90
manuscript received 29 Jul 80

LABUTIN, V. K.

[Abstract] A nomogram is presented which is intended for determination of the parameters of an analog-digital conversion of signals, taking account of their dynamic range and the deterioration of the signal-to-noise ratio as a consequence of the sampling readings.
[265-6415]

UDC 621.391.821

STATISTICAL CHARACTERISTICS OF ATMOSPHERIC RADIO NOISE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 384-387 manuscript received 24 Dec 79

SHLYAKHIN, V. M.

[Abstract] Atmospheric radio noise is one of the sources of the inherent obstacles to radio electronic agents. At present the statistical characteristics of this noise are still not completely studied, which hampers the performance of a number of special investigations. Experimentally, it has been determined that the distribution of small values of the amplitude of radio noise corresponds to the Rayleigh law; large values to the logarithmic normal distribution law (LNDL). This made it possible to present atmospheric radio noise in the form of an adaptive mixture of two random processes $ae^{i\phi}$ and $be^{i\phi}$. The statistical properties of the amplitudes of a and b are described, respectively, by the Rayleigh distribution law and the LNDL. With the use of such representations of atmospheric radio noise, the author determines their basic statistical characteristics. For practical calculations of the correlation coefficient of the amplitude of radio noise in a given case it is possible to make use of a known expression for the correlation coefficient which corresponds to a two-dimensional Rayleigh distribution of amplitude. References 7: 6 Russian, 1 Western.
[264-6415]

UDC 621.395.44

RECONSTRUCTION OF COAXIAL CABLE TRUNK LINE

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 28-31
manuscript received 27 Dec 79

SHAMUILOV, Ya. I.

[Abstract] In the USSR coaxial cable lines equipped with the K-1920 electron-tube transmission system are widely utilized on long-distance communication networks. The system which was developed more than 20 years ago does not assure the required characteristics and economical indices for routes and channels and consequently is subject to replacement by more contemporary equipment. The present paper describes how specialists from TTsUMS-10 (Territorial Center No 10 for Management of Nation-Wide Communication Services and Television) under the direction of the Central Scientific-Research Institute of Communication conducted reconstruction of part of an operative trunk line by replacing the K-1920 by the VLT-1920 transistorized transmission system produced by GDR industry. In the course of a year observations of the reconstructed part of the trunk line showed a considerable improvement in its principal parameters. The following subjects are considered: 1) Organization of Work; 2) Results of adjustment of line routes

of VLT-1920; 3) Stability of Characteristics; and 4) Reliability of System. Figures 1; tables 4; references: 1 Russian.
[262-6415]

UDC 621.395.91

TIME SERVICE EQUIPMENT FOR MUNICIPAL TELEPHONE STATIONS

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 19-22
manuscript received 5 Feb 79

BARANOV, Yu. A., KUSHMANOV, I. V. and POPOV, O. B.

[Abstract] The paper describes the time service equipment (TSE) of the "Govoryashchiye Chasy [Speaking Clock]" type developed by specialists of the scientific-research sector of the Moscow Order of the Red Banner of Labor Electrical Engineering Institute of Communications. The equipment is intended to supply the subscribers of the telephone networks in large cities and various dispatcher services with information concerning time in vocal form. The TSE delivers information concerning time with a precision up to 1 minute. Laboratory tests of the most important units of the TSE in heavy-duty regimes, as well as tests which took place at the Sverdlovsk and Minsk telephone exchanges, made it possible to guarantee its normal operation during the course of not less than 5 years. The principal technical characteristics of the equipment are presented. Figures 2; references: 3 Russian.
[262-6415]

UDC 621.395.344

SPECIAL FEATURES OF CROSSBAR AUTOMATIC TELEPHONE STATIONS OF THE 'PENTAKONTA' SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 15-19
manuscript received 5 Nov 79

KVRIVISHVILI, R. K. and SHARASHENIDZE, A. I.

[Abstract] This paper is designed to help readers become more familiar with the crossbar automatic telephone stations (ATS) of the "Pentakonta" system (ATSKP) which is particularly important because this system is being introduced into the municipal telephone networks of Moscow, the Ukraine and Belorussia. The ATSKP system is one of the crossbar ATS systems in which many effective ideas for construction of switching points are realized. It assures a high quality of service for subscribers with economical construction of networks. In the course of introducing the ATSKP into the Moscow telephone network problems arose concerning its operation with ATS of other systems (crossbar and ten-step): adjustment of

registers for use of other signal codes, development of required sets of telephone relays, introduction of the necessary equipment to take account of long-distance calls, and so on. A detailed account of these problems and the means of their solution is given in a paper by Yu. I. Yemel'yanova (ELEKTROSVYAZ', 1980, No 1). The present paper covers the following points in some detail: 1) The principal switching device of the ATSKP, a description of a crossbar switch (MKS), and a scheme illustrative of a method of obtaining 74 outlets in each vertical MKS; 2) Structure of selection units; 3) A controlling device for ATSKP; and 4) Establishment of connections on the ATSKP. Figures 4; tables 2; references 11: 6 Russian, 4 Western, 1 Polish.
[262-6415]

UDC 621.396

USE OF THE METHOD OF NORMAL WAVES FOR INVESTIGATION OF EXTENDED RADIO PATHS

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 293-297 manuscript received 29 Apr 80

KURKIN, V. I., ORLOV, I. I. and POPOV, V. N., Siberian Institute of Terrestial Magnetism, Ionosphere and Radio Wave Propagation, Siberian Affiliate, USSR Academy of Sciences

[Abstract] Determination of the conditions most favorable for radio communications is one of the most important tasks in the problem of excitation and propagation of shortwave signals. In real situations the number of factors substantially affecting these conditions is extremely large. In a model statement of the problem (spherical symmetrical waveguide earth-ionosphere) the authors analyze the role of the conductivity of the underlying surface, the magnetic field of the earth and the characteristics of the radiator. The analysis is conducted on a basis of the method of normal waves, one of the virtues of which is the possibility of a study of the excitation and propagation of radio waves within the framework of one problem. This fact is extremely important because the requirements imposed on the transmitting system must be formulated on the basis of the physical concepts concerning the propagation of radio waves. The study makes it possible to formulate requirements for antennas from the point of view of long-range radio communication and quantitatively to evaluate the efficiency of one or the other antenna. Figures 2; references 5: 4 Russian, 1 Western.
[264-6415]

UDC 621.396:621.391

FUNCTION OF SPACE-TIME CORRELATION OF A NARROW-BAND ISOTROPIC NOISE FIELD

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 49-52
manuscript received 29 Jul 80

CHAYKOVSKIY, V. I.

[Abstract] Informatively, a function of space-time correlation fully represents a Gaussian isotropic stationary noise field, which is often used as a model of real acoustic (sound) fields in systems for space-time processing of hydroacoustic, geophysical and some biomedical signals. The present paper obtains such functions of space-time correlation in the form of the product of two independent components—the function of space correlation and autocorrelation function of noise generation. Expressions for these components are presented. An asymptotic representation is obtained of the functions of space-time correlation in the form of the product of the independent components of space and time correlations valid for a narrow-band isotropic stationary noise field. Analytical expressions for these components are presented. References 4: 3 Russian, 1 Western.
[265-6415]

UDC 621.396.2.029.5/51:621.391.821

MODELS OF RADIO INTERFERENCE OF NATURAL ORIGIN (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 211-237
manuscript received 7 Dec 79

REMIZOV, L. T.

[Abstract] This review of the progress since 1956 (Ya. I. Likhter, RADIOTEKHNIKA I ELEKTRONIKA Vol 1, No 10, pp 1295-1302) and the present state of the art in study and understanding of radio interference is confined to radio interference of natural origin, atmospheric and to some extent industrial. Different models of atmospheric radio interference have been developed in order to fit narrowband and wideband reception, respectively. They are essentially of three types: statistical models describing a random process at the receiver output, space-time models describing distributions of the environmental influencing factor over geographical territories as well as over time periods (diurnal, seasonal, annual), and radiophysical models describing combinations of physical processes in a natural random field. None of these models is complete, inasmuch as each is oriented toward specific practical receiver design and application objectives. One way to overcome this deficiency is further to refine these models with more emphasis on measurability. Another way is to establish qualitative and quantitative relations between any number of them, as a basis for combining them. The third way is to develop an altogether new broader and more precise model. References 43; 22 Russian, 21 Western.
[260-2415]

UDC 621.375(087.2)

ADAPTATION OF INFRADYNE RADIO RECEIVERS WITH WIDE-BAND PRESELECTOR ACCORDING TO THE CRITERION OF DYNAMIC RANGE

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 16-19
manuscript received 8 Jun 80

BOGDANOVICH, B. M., VORONOV, A. I. and POZNYAK, S. S.

[Abstract] The paper considers the urgent problem of creating the principles of adaptation of radio receivers with wide-band preselectors, the dynamic range of which, and, consequently the power requirements, do not remain constant and fluctuate as a function of the actual noise conditions at the point of reception. The following points are discussed: 1) Probability criterion of the quality of operation of radio receivers with wide-band preselectors; 2) Effect of automatic control of sensitivity at the interference threshold of a radio receiver; 3) Effective algorithms of adaptation of radio receivers with interference threshold and automatic sensitivity control; and 4) Effectiveness of adaptation. Figures 5; references 7: 5 Russian, 2 Western.
[265-6415]

UDC 621.396.6

JOINT OPTIMIZATION OF SOME PARAMETERS OF RADIO ELECTRONIC DEVICES DURING CONSTRUCTION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 84-86
manuscript received 16 May 80

BALBABYAN, S. A.

[Abstract] One of the principal problems in the construction of radio electronic devices is the joint optimization of some parameters which is fairly difficult but very important. The basic difficulty lies in the fact that optimization of one of the parameters has an affect on another. A 1965 paper from the literature presents a general statement of the problem of optimization with multicriterial (multipurposeful) functions. The present paper gives an account of a procedure for investigation of a multicritical function with use of the theory of graphs based on the concepts of compatability of graphs and the area of freedom of a radio element. The example presented confirms the merit of the proposed procedure during the solution of several optimization problems. Figures 2; references: 6 Russian.
[265-6415]

UDC 621.396.022.029.7

CONCERNING REQUIREMENTS ON THE PRECISION OF GUIDANCE IN OPTICAL COMMUNICATION SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 86-88
manuscript received 21 Feb 80

BORISOV, E. V. and KISELEV, A. K.

[Abstract] It is important to evaluate the effect of guidance errors of the optical radiation on the most important parameter of an optical system of communication--the reliability of information transmission, as well as to solve the inverse problem--on the basis of data concerning realizable power of transmission and the requirements on the reliability of information transmission, to determine the permissible guidance errors or the necessary precision of the guidance system. These problems are solved in the present paper for channels with a low level of turbulence when the guidance errors are a controlling factor which reduces the reliability of information transmission in a communication system. The most typical engineering problem is determination of the necessary precision of guidance at a given level of the signal and noise and the requirements on the reliability of information transmission. For this reason a graph is shown of the dependence of the maximum permissible guidance errors as a function of the relative level of the signal with a specified probability of error of reception of an elementary symbol. Two relations are derived which make it possible to evaluate the effect of guidance errors on the quality of the optical communication system with pulse-code modulation and discrete modulation of the subcarrier oscillations, and to formulate requirements on the precision of guidance with a given reliability of information transmission and radiation power. Figures 2; references 4: 3 Russian, 1 Western.
[265-6415]

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES, CAVITY RESONATORS AND FILTERS

UDC: 535.8

TRANSMISSION OF LIGHT BY ADIABATIC LIGHT GUIDES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80 pp 36-39 manuscript received 23 Nov 78

MOSENZHNIK, Yu. U. (deceased), TSIRLIN, Yu. A. and POMERANTSEV, V. V.

[Abstract] Previous studies of adiabatic light guides with constant cross section used to connect a rectangular light source with a circular receiver of equal area are described. The authors of this article decided to find the transmission of a light guide with a rectangular input aperture measuring a x b, and an output aperture which is a square with a side $C = \sqrt{ab}$ as a function of the height of the light guide h. The cases of mirror reflection and total internal reflection on the side surface were considered. The interaction of the light beam emitted by the source with the adiabatic light guide is considered for an isotropic or cosine-rule source. Light guides with identical areas of input and output apertures do not yield the transmission predicted in earlier works even with mirror reflection. As the height of the light guide increases, the stabilization of transmission increases. Adiabatic light guides have no significant advantages over light guides with differenc values of input and output aperture areas. Figures 5; references 7: 5 Russian, 2 Western.
[256-6508]

UDC 681.7.068.4

GEOMETRICAL-OPTICS METHOD OF CALCULATING THE LIGHT LOSS IN A GASEOUS-DIELECTRIC LIGHT GUIDE WITH AN ASYMMETRIC CROSS SECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 238-248 manuscript received 12 Sep 80

BUKHTIAROVA, T. V. and ZHABOTINSKIY, M. Ye.

[Abstract] The paper considers a gaseous-dielectric light guide, a device consisting of a thin tube filled with a gas optically denser than the ambient medium with a cross section in the form of two nonconcentric circles and consequently a

nonuniform wall thickness. Measurements of the light loss in such a light guide have yielded values several orders of magnitude larger than design calculations based on a uniform wall thickness. The light loss in such a waveguide is calculated by the geometrical optics method with the asymmetry of the cross section taken into account. The mean energy reflection coefficient is determined from its angular distribution over the circumference, assuming that at every angle it is equal to the reflection coefficient for a plane wave at a wedge. Both the propagation of a meridional light ray in such a light guide and the sliding incidence (with shifting of successive rays) of a plane wave on a wedge are analyzed on this basis. The light loss is then calculated for a light guide with an arbitrary cross section, with the nonuniformly thick wall replaced with elementary segments of different thicknesses but with the thickness of each uniform and equal to its mean thickness. An analysis of the results indicates the tolerance on the circumferential thickness taper relative to wall thicknesses (for glass) corresponding to resonance and antiresonance at given wavelengths. The authors thank A. A. Dyachenko for formulating the problem and for his steady assistance, as well as B. Z. Katsenelenbaum and V. V. Shevchenko for helpful discussion. Figures 8; tables 1; references: 8 Russian.
[260-2415]

UDC: 535.8:666.189.2

MULTICHANNEL FIBER OPTICAL SPLITTERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80
pp 35-36 manuscript received 13 Nov 79

ISAKOV, V. P., KLIMOV, I. I., LAVROV, V. N., FIRSOV, V. M., KHODAKOVSKIY, M. D.
and SHIDLOVSKIY, R. P.

[Abstract] Splitters, which passively divide an optical signal among several channels, are among the most important elements in complex multichannel fiber optical information transmission systems. This article reports on the preliminary results of studies of splitters using fibers with thin envelopes. Optical fibers of multicomponent glass, core diameter 280 micrometer, outside diameter 300 micrometer were placed in bundles and fused by a flame in order to produce a single rod 2 to 10 mm in length. A photograph of such a fused section is presented. The device operates by total internal reflection, distributing the light power input through any one fiber approximately uniformly among all the exit fibers because of the biconical shape of the constriction, which makes a very effective distributing element. Losses of 2.8 to 3.1 dB are reported for splitters with 2 to 5 fibers. Figures 2; references: 4 Western.
[256-6508]

UDC: 66.018.2:681.7.068.13

STABILITY OF FLEXIBLE FIBER OPTIC ELEMENTS TO MECHANICAL EFFECTS AND THE INFLUENCE OF THE ENVIRONMENT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80
pp 39-43 manuscript received 20 Jul 77

KARMANOV, S. M., LEBEDEVA, L. I., SHERSHAKOVA, I. V., KHOMYAKOV, A. N.

[Abstract] The results are presented from studies of the mechanical strength of fiber optic bundles subjected to bending to angles of 90 and 360° and twisting to 360°. The variation of mechanical strength as a function of cross section and types of external protective shells is noted. As the cross section of the bundle increases its mechanical strength per unit area decreases. Bundles in latex envelopes were most resistant to 90° bending, followed by silicone envelopes, with polyvinyl chloride envelopes being least protective. The fiber optic bundles were exposed to high and low temperatures, cyclical temperature changes, moist atmospheres, fuel and lubricant materials and boiling water. Increased humidity was found to be the most dangerous environmental influence, greatly reducing light transmission, though the other factors all produced matte surfaces on the ends of the fibers. Figures 5; tables 2; references: 2 Russian.
[256-6508]

UDC 621.372.8.049.75.001:621.318.134

REFLECTION FROM THE OPEN-CIRCUIT END AND THE SHORT-CIRCUIT END OF A SYMMETRIC STRIPLINE FILLED WITH A FERRITE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 269-276
manuscript received 15 Oct 79

POPOV, V. P.

[Abstract] Reflection of a TEM wave from the open-circuit end and the short-circuit end of a symmetric stripline is analyzed by the A. A. Oliner method, this stripline being filled with a transversely magnetized ferrite. Because in this case a backward wave has a different structure than a forward wave, higher-order modes are excited at both ends. This is taken into account in the solution of the fundamental equations for a semiinfinitely long stripline with magnetic walls. The solution is aided by a conformal mapping of the stripline and by extraction of a quasi-static component at the short-circuit end for faster convergence. The reflection coefficients at both ends are calculated analytically on this basis. The electromagnetic field at a ridge where the magnetic field can build up without limit is also calculated. Internal losses at such a ridge are found to decrease the reflection coefficient at the short-circuit end appreciably, but only slightly the reflection coefficient at the open-circuit end. Figures 3; references 7: 5 Russian, 2 Western.
[260-2415]

UDC 534.284

EFFECT OF DIFFRACTIONAL DIVERGENCE OF SURFACE ACOUSTIC WAVES ON THE FREQUENCY CHARACTERISTICS OF SURFACE-ACOUSTIC-WAVE FILTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 398-401 manuscript received 11 Nov 79

RAZGONYAYEV, V. K. and YAKOVKIN, I. B.

[Abstract] The amplitude-frequency characteristic of a surface-acoustic-wave (SAW) filter is calculated, assuming a linear source of surface acoustic waves on an anisotropic substrate and an approximately parabolic dependence of the wave velocity on the wave deflection angle. The amplitude of the filter output signal at a given frequency is obtained by summation of second Fresnel integrals over all radiator-receiver pairs, with the apodization factor and the phase delay taken into account. The results of calculation by this method agree closely with experimental data where diffractional effects predominate over other secondary effects. The amplitude-frequency characteristic of an SAW filter can thus be treated as the sum of some ideal amplitude-frequency characteristic and a corrective term representing the effect of diffraction. The magnitude of this term and thus the effect of diffraction depend on the filter design parameters. Figures 4; references 8: 2 Russian, 6 Western.
[260-2415]

UDC 538.56:627.372.55

STATIONARY CHARACTERISTICS OF AN ADAPTIVE TRANSVERSAL FILTER

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 326-333 manuscript received 17 Apr 80

MAL'TSEV, A. A. and PATRONIS, Ye. T., Gor'kiy State University

[Abstract] The problem of deriving precise analytical expressions for the stationary characteristics of widely-used adaptive transverse filters is a most important one. In the present paper this problem is solved for such a filter with an arbitrary number of weights and exponential--correlated input signals. The results obtained make it possible, in particular, to evaluate rapidly the effectiveness of operation of an adaptive transversal filter when it is used for the purpose of identification of unknown systems or for automatic compensation of noises. Two examples are given of modelling unknown dynamic systems with the aid of an adaptive transverse filter. In the first example a fixed time delay is taken as the unknown system; in the second, a low-frequency linear filter of the first order. Figures 5; references 6: 3 Russian, 3 Western.
[264-6415]

UDC 621.372.061

NONLINEAR DISTORTION IN TWO-CIRCUIT FILTERS WITH ELECTRONIC TUNING OF FREQUENCY

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 41-43
manuscript received after completion 13 May 80

MATVEYEV, S. Yu.

[Abstract] The paper investigates phenomena connected with the nonlinear selectivity of a two-circuit tunable filter with nonlinear capacitance--varicaps. The equipment used for analysis is based on use of the Volterra series, which makes it possible to evaluate inertial nonlinear devices with multisignal effects. Experimentally obtained amplitude-frequency characteristics for various amplitudes of the input signal, normalized with respect to the maximum, coincide satisfactorily with the results of machine calculations. Figures 3; tables 1; references: 4 Russian.
[265-6415]

UDC 621.372.54.01

SYNTHESIS AND ANALYSIS OF CERTAIN QUASI-OPTIMUM LINEAR TWO-DIMENSIONAL DISCRETE FILTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 326-333
manuscript received 15 Sep 78, after revision 19 Jun 80

KATOMIN, N. P.

[Abstract] An optimum filter which operates according to the laws of linear regression has already been constructed for space-time processing of images or discrete data with an information carrying parameter of a two-dimensional argument. Optimum (with minimum mean-square error) estimates of a random process at discrete time intervals are described by recurrence relations where the expressions for the amplification factors contain only a priori known quantities and elements of the a posteriori correlation matrix. Accordingly, this filter is a nonstationary linear one with a variable structure. Now two such quasi-optimum filters are considered which can approach the optimum one but require fewer active channels for arithmetic operations and thus a smaller memory. With the basic scheme the same, the first one is a quasi-optimum filter with limited interpolation and the second one is a filter with quasi-optimum generation of amplification factors. Both involve stipulation of a small positive whole number, n or m respectively. Here their performance is analyzed comparatively in terms of estimates and dispersons along the "running recurrence line" for n,m from 0 to 5, approaching the optimum filter. The author thanks B. A. Yufryak for discussions and helpful comments. Figures 3; references 4: 1 Russian, 3 Western (one in translation).
[260-2415]

UDC 621.372.852.1

DEVICE FOR INCREASING THE PRECISION OF TUNING OF MICROWAVE FILTERS

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 pp 36-39
manuscript received 6 Feb 80

RABINOVICH, G. I.

[Abstract] During transmission of a signal by multichannel radio relay lines, the linearity of the phase characteristics of the elements of these lines, which to a considerable degree determines the quality of transmission of communication, has a significant value. Ordinarily, the phase characteristics is not normalized and measured, but its derivative--the group time lag (GVZ) which is determined with the aid of the F4-15 GVZ meter, or the analyzer of microwave lines, the MLA 3710A by the firm of Hewlett Packard, and a corresponding frequency converter. These instruments have an error of the frequency marker of ± 0.5 MHz which essentially does not affect the precision of measurement of the GVZ of wide-band devices. However, the error of measurement of GVZ of highly selective band-pass filters can reach a considerable magnitude. Consequently, a device was developed which makes it possible to decrease the magnitude of this error. The present paper is concerned with: 1) An evaluation of the error of measurement of the characteristics of GVZ; and 2) A description of a block diagram connected with measurement of the characteristics of microwave filters. It is concluded that the device developed assures an increase of the precision and the acceleration of the process of alignment of microwave filters. During a study of the attachment to the P2-41 and P2-45 instruments, the precision of the frequency marked increased and the error of measurement of the resulting characteristics of the GVZ decreased. The calibrator makes it possible to perform an alignment of filters both in the passband and with large reflections. In so doing the necessity falls off for reorientation of the directional detector of the instrument and disconnection of the measurable filter. Figures 4; references: 2 Russian.
[262-6415]

UDC 621.391.8

APPROXIMATION METHOD OF DETERMINING PARAMETERS OF A NONSTATIONARY FILTER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 2, Feb 81 pp 18-23 manuscript received 20 Jun 80

BUKHARIN, S. V.

[Abstract] Use of filters with variable parameters is an efficient means of struggle with the transient distortion of a pulse signal. In particular, a satisfactorily simple and realizable nonstationary filter which consists of an adjustable amplifier with a variable gain and a selective quadripole with a transfer function assures a substantially smaller distortion of frequency-modulated signals than a fundamental quadripole. In engineering practice a

requirement arises for comparatively simple formulas which make it possible operationally to conduct a rational choice of the parameters of a nonstationary filter with the aid of elementary computing techniques. The present paper states and compares two different methods of approach to determining an approximation of the parameters of nonstationary filters. The paper was recommended by the Department (Kafedra) of Technical Cybernetics and Automatic Control, Voronezh State University imeni Lenin Komsomol. Figures 2; references 4: 3 Russian, 1 Western (in translation).
[266-6415]

UDC 621.3.049.77:681.32

EXPANSION OF DYNAMIC RANGE OF ANALOG MULTIPLIER WITH VARIABLE SCALING OF THE SIGNAL

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 40-41
manuscript received 16 Jul 80

MOCHKIN, V. S., TARASOV, V. P. and LAPENKO, V. N.

[Abstract] A method is described for increasing the dynamic range of analog multipliers (AM) with the aid of a variable scaling of the input and output signals of the AM so that operation is assured in a comparatively optimum region of the input signals. A number of restricting factors listed in the paper have almost no effect. A block diagram is presented of the simplest variation of the device and its method of operation is explained. Figures 2; references: 1 Western (in translation).
[265-6415]

UDC 621.372.853

ABSORBER SYSTEMS WITH SOLID DIELECTRICS

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 2, Feb 81 pp 251-255 manuscript received 10 Apr 80

BYKOV, A. A. and IL'INSKIY, A. S., Moscow State University

[Abstract] Absorber systems in a plane waveguide are considered which use dielectrics with a large loss tangent ($\tan \delta = 0.1$) and a high permittivity ($\varepsilon = 25.0$). Calculations are made here for H_{m0}-modes, which in the two-dimensional problem do not transform to other modes. The incomplete Galerkin method reduces the Maxwell field equations to a boundary-value problem for linear ordinary differential equations. Three designs of a nonresonant absorber have been obtained on the basis of numerical solutions, each constituting a dielectric waveguide transformer. The interface between two homogeneous media (air and dielectric) has the form of an inclines plane, a symmetric wedge, and a staircase,

respectively. Small reflection over a wide range of wavelengths is attainable with a long inhomogeneity. Also a resonant absorber has been designed, where an oblique quarter-wave plate ($\varepsilon = 4.0$) separates the empty waveguide segment (air $\varepsilon = 1.0$) from the waveguide segment filled with a dielectric ($\varepsilon = 25.0$). In this case small reflection within a narrow range of wavelengths is attainable with a short inhomogeneity, its length being or the order of the waveguide height. Figures 4; references: 3 Russian.
[261-2415]

UDC 621.374.4

SYNTHESIS OF CONTROLLABLE SHAPER OF PERIODIC OSCILLATIONS OF COMPLEX FORM

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 37-40
manuscript received 28 Mar 80

YEGOROV, Ye. A. and SEDYKH, M. M.

[Abstract] A method is presented for synthesis of a controllable shaper of variable oscillations, the form of which can be changed by the amplitude of the harmonic input signal. Selection of the amplitude as the variable parameter is caused by the simplicity of control and the possibility of programming the operation of the controllable shaper. The shaper obtained consists of two nonlinear converters, a differentiator and a low-frequency filter. An example is given concerned with a shaper which has two possible forms of oscillations. Figures 2; references 9: 8 Russian, 1 Western.
[265-6415]

UDC: 621.391.268

ESTIMATE OF THE INFLUENCE OF SPECTRAL WIDTH OF A RADIATOR ON THE OUTPUT SIGNAL OF A COHERENT OPTICAL CORRELATOR

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 81
pp 8-12 manuscript received 25 Mar 80

KAVTOROV, V. V.

[Abstract] An analysis is presented of a case of application of coherent optical correlators not reported previously in which a holographic filter is produced by means of a monochromatic source, while signal processing is performed using a wideband source. A diagram of the correlator is presented. The results of mathematical analysis of the design indicate that it is desirable to have a priori information on the nature of the signals which will be processed by the device in order to select the permissible value of spectral width of the radiator used. Figures 2; references 19: 9 Russian, 9 Western, 1 Polish.
[273-6508]

IN THE SCIENTIFIC-TECHNICAL COUNCIL OF THE USSR MINISTRY OF COMMUNICATIONS

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 81 p 49

[Abstract] In October 1980 a session was held of the Scientific-Technical Council of the USSR Ministry of Communications on the theme "Summary of linear tests and trial operation of the K-3600 equipment. Indices of performance and quality. Prospects for introduction of the system." The K-3600 is a system of transmission on 3600 channels for main line networks. The first main line cable equipped with the K-3600 transmission system was placed in operation at the end of 1979 for transmission of television and telephone communications during the Olympic games. During installation work certain shortcoming of the equipment were exposed (unreliable operation of the SER-2 device in the automatic level control, breakdowns of the microcircuit in the telemechanics system, nonhermetic containers, insufficient crosstalk attenuation in container of unattended repeater station). With adjustment, these shortcomings were promptly removed. Linear tests and trial operation of the first main line with the K-3600 system showed the necessity for supplementing it with a number of devices not provided for by the developers. The Scientific-Technical Council approved the work conducted with respect to the creation and introduction of the K-3600 transmission system and recommended its use as a basic system during reconstruction of existing and the construction of new long lines. The paper lists a number of decrees issued by the Council with respect to new work.
[262-6415]

CRYOGENICS AND SUPERCONDUCTIVITY

UDC 537.312.62

INTERFERENCE-IMMUNE SUPERCONDUCTING QUANTUM INTERFEROMETER

Kiev AVTOMATIKA in Russian No 2, Mar-Apr 81 pp 75-79
manuscript received 16 Mar 79

VOYTOVICH, I. D., MIKHAYLOV, G. A. and SOSNITSKIY, V. N., Institute of Cybernetics, UkSSR Academy of Sciences

[Abstract] A superconducting quantum interference device with two Josephson tunnel junctions (an upper layer and a lower layer) and a control film is described which features a high immunity to extraneous magnetic fields and a high sensitivity. The device is controlled by a magnetic field and is self-shielded by a superconducting ring into which the upper electrodes of both junctions are connected. This construction with two lobes in parallel offers an effective area of the quantizing circuit equivalent to that of a conventional single-lobe SQUID (superconducting quantum interference device); but with a lower inductance and thus a deeper modulation of the critical current. The control characteristic can be regulated, its slope and thus the sensitivity of the device as a null indicator increased, by varying the distribution of the supply current between the two lobes. There is much flexibility in the configuration, especially in positioning of the control film and, furthermore, the performance is quite insensitive to imprecision in the matching of layers. When the lobes are not identical, for instance, then the period of oscillations of the critical current can depend on the directions of the supply current and the control current relative to one another. This ambiguity can be eliminated, however, by splitting the supply current not only at the input but also at the output of the SQUID. The performance of such devices with $Nb-Nb_xO_y-Pb$ junctions (upper layer 103 micrometer wide, lower layer 63 micrometer wide) has been evaluated experimentally and the results of analysis confirmed by measurements. Figures 5; references 3: 2 Russian, 1 Western.

[275-2415]

ELECTRICAL ENGINEERING
EQUIPMENT AND MACHINERY:
APPLICATIONS AND THEORY

UDC 621.3.066.6.019.3.001.4

MULTIPOLAR HERMETICALLY-SEALED POWER REED RELAY CONTACTORS FOR METALLURGICAL AND AGRICULTURAL DEVICES

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 81 pp 47-49
manuscript received 27 Mar 80

KOBLENTZ, M. G., candidate of technical sciences

[Abstract] Information is presented on multipolar power hermetically-sealed reed relay (gerkon) contactors used in production processes under difficult conditions of the environment. A photograph is shown of a gerkon contactor with three main and four auxiliary normally-open contacts with control from a direct-current network; operation of the unit is described. The principal characteristics of gerkon contactors KMG and KMG 18 are presented. Use of these contactors in metallurgical production and at agricultural units makes it possible to increase markedly the reliability of operation of electrical equipment, and use of the gerkons which fulfill the function of auxiliary contacts--more widely to introduce logical circuits. Figures 2; references: 3 Russian.
[267-6415]

UDC 621.313.8.001.1

DEVELOPMENT OF ELECTRICAL MOTOR FOR PRECISION LOW-SPEED ELECTRIC DRIVES

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 81 pp 55-56
manuscript received 17 Dec 79

ADAS'KO, V. I., VESELOVSKIY, V. M., candidate of technical sciences, and
DUVANOV, Yu. T., engineer

[Abstract] Recently, in connection with the development of automation means, computing techniques and special devices, into the composition of which tape transports enter, the necessity arose for electric drives which possess a high degree of uniformity in the frequency of rotation. The principal technical requirements--often inconsistent--introduced during development of such highly precise low-speed drives are discussed in the present paper, as well as the

problems encountered in furnishing the various types and accomplishments of the electric motors used in the drives. It is shown that the many-sided requirements on precision low-speed electric drives are most fully satisfied by an electric drive on the base of a direct-current motor in which the armature of the motor is made to be nonburdened and unslotted, and the number of collector plates at the pole must be the maximum possible. References: 6 Russian.
[267-6415]

UDC 621.314.1.001.1

ELECTRIC VEHICLE DRIVE BASED ON A DIRECT-CURRENT CONVERTER

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 81 pp 56-59
manuscript received 13 Sep 79

BULATOV, O. G., candidate of technical sciences, LABUNTSOV, V. A., dr of technical sciences, POLYAKOV, V. D., engineer, and TSARENKO, A. I., candidate of technical sciences

[Abstract] Problems are considered connected with the construction of an electric vehicle based on a motor with separate excitation, the armature circuit of which is fed from a thyristor converter with series capacitor commutation. The circuit of the drive, the mechanical characteristics of the drive and the choice of the parameters of the converter are discussed. It is concluded that the circuit considered assures obtaining of mechanical characteristics favorable for the conditions of a traction electric drive. The high commutation stability of the converter, facilitated by the operating conditions of the semiconductor devices, the simplicity of the power circuit and the control system, as well as the parametric restriction of the current determine the high reliability of the drive operation as a whole in all possible regimes. The high work rate of the converter determines the good specific mass-dimension indices. The increase of frequency of the converter leads to a reduction of the magnitude of the inductance of the smoothing choke, which makes it possible to increase the efficiency of the drive because the smoothing choke is one of the principal elements which determine losses in the circuit. Figures 6; references 2: 1 Russian, 1 Western.
[267-6415]

UDC 621.314.6.027.3

HIGH-VOLTAGE RECTIFIERS OF THE MOSCOW PRODUCTION ASSOCIATION 'ELEKTROZAVOD' IMENI V. V. KUYBYSHEV

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 81 pp 24-27
manuscript received 14 Aug 79

UL'YANOV, Ye. P., YEFREMIDI, A. L. and SYRICHEV, I. Ya., engineers

[Abstract] A survey is made of high-voltage rectifiers for various purposes developed and manufactured at the Moscow "Elektrozavod" [Electrical Plant]. Approximately 100 types with a power of 5-1000 kW and a voltage of 5-250 kV are produced. It is shown that use of silicon rectifiers in high-voltage rectifying units encounters definite difficulties because of the complex dynamic effects which apply to rectifiers on the part of a load with spark and arc breakdowns. Methods are described for protection of silicon rectifiers from pulse current effects and overvoltages. The investigations conducted showed that the cause of overestimating no-load voltage of a rectifier is the structural (stray) capacitance of the winding of the high-voltage transformer at the ground members of the transformer and tank. A new basic treatment of a high-voltage rectifier for charging the resevoir capacitors of pulse units, which effectively utilizes the structural capacitance of the windings of a high-voltage transformer to the ground, makes it possible to decrease the dimensions of pulse-current generators of the GIT series, and to increase the reliability of their operation. A method is described for symmetrical shielding of rectifier networks from overvoltage. Figures 4; references: 2 Russian.
[267-6415]

UDC 621.316.933:537.525.5

INVESTIGATION OF THE PROCESS OF ARC CONTROL IN SHUNTING SPARK GAPS OF A LIMITER OF DIRECT CURRENT OVERVOLTAGE BASED ON ZINC-OXIDE RESISTORS

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 81 pp 44-47
manuscript received 10 Jul 80

VOL'KENAU, V. A., LAVRENT'YEV, G. G., candidates of technical sciences, and ROGOVENKO, S. Yu., engineer

[Abstract] The zinc-oxide resistors (ZOR) developed in recent years open many possibilities for improvement of protective equipment. Recently, development of direct-current discharges with the use of ZOR and spark gaps has been conducted at the Yerevan department of the All-Union Order of Lenin and Order of the October Revolution Electrical Engineering Institute imeni V. I. Lenin. It is shown in the present paper that the successful use in direct-current discharges with zinc-oxide resistors of simple and reliable spark gaps with a rotating arc makes it possible to use them for shunting in prospective limiters. Their arc

control characteristics are determined for this case. There is a possibility in principle of creating protective equipment with a protective level up to 1.7 and a 15 kA current. The number of spark gaps in it is assumed to be minimal, determined only the breakdown conditions. Figures 6; references 6: 5 Russian, 1 Western.
[267-6415]

UDC 534.2-16:534.483

MECHANISM OF 'RESIDUAL' ACOUSTIC WAVE LOSSES IN SOLIDS AT LIQUID-HELIUM TEMPERATURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 402-408
manuscript received 30 Jan 80

IVANOV, S. N. and KHAZANOV, Ye. N.

[Abstract] "Residual" absorption of bulk acoustic waves in semiconductor and dielectric crystals is the temperature-independent component of total absorption at liquid-helium temperatures, the difference between total absorption and absorption caused by phonon-phonon interaction. An experimental study was made to determine the cause of this "residual" absorption. The experiment was performed by the echo method at temperatures down to 4.2 K. The dependence of the "residual" absorption on the frequency and on the Debye temperature at 1 GHz was measured for longitudinal acoustic waves in InSb, Ge, Al_2O_3 crystals and for shear waves in $LiNbO_3$ crystals, such crystals serving as acoustic waveguides. Earlier studies had revealed that neither impurities nor defects could be the cause of "residual" absorption. The results of this study indicate that the principal mechanism of "residual" absorption is diffuse scattering of a coherent acoustic wave by "rough" surfaces of mirrors in the acoustic resonator, this surface roughness being determined by the technology of surface treatment as well as by the hardness of the material. A theoretical interpretation of this mechanism is based on reflection of a normally incident wave by a randomly uneven surface according to the Rayleigh roughness criterion for phase change. The possibility of controlling "residual" absorption was tested by special treatment of one acoustic mirror. Using a finer-grade abrasive of matching hardness was found to lower the absolute magnitude of the absorption coefficient and to lower its saturation frequency. Figures 4; references 20: 4 Russian, 20 Western (five in translation).
[260-2415]

UDC 621.37/39:534

ACOUSTOELECTRONIC ABSORPTION OF SURFACE ACOUSTIC WAVES IN A PIEZODIELECTRIC-SEMICONDUCTOR STRUCTURE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 409-415
manuscript received 5 Feb 80

FEDOSOV, V. I.

[Abstract] Acoustoelectronic absorption of surface acoustic waves in a split 2-layer structure consisting of a low-resistivity semiconductor and a piezodielectric is considered, taking into account the kinetics of charge carrier entrapment in surface electron states. The dependence of the absorption coefficient on the electrostatic potential at the semiconductor surface is calculated by the Ingebrigtsen method, assuming a semiconductor thickness much larger than the wavelength and disregarding charge accumulation in the surface states. Typical results for an n-Si/$LiNbO_3$ structure and surface acoustic waves traveling at a velocity of $3.49 \cdot 10^3$ m/s^3 along the free surface of the piezodielectric at a temperature T = 300 K indicate that the absorption coefficient peaks in the vicinity of a zero surface electrostatic potential, within its range where absorption is strongly influenced by the existence of surface electron states. The author thanks S. G. Kalashnikov and A. I. Morozov for constructive discussions. Figures 1; references 17: 8 Russian, 9 Western.
[260-2415]

ELECTROMAGNETIC WAVE PROPAGATION, ELECTRODYNAMICS

UDC 537.8

REFLECTION OF ELECTROMAGNETIC WAVES BY A CYLINDER OF FINITE LENGTH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 286-293
manuscript received 2 Apr 80

UFIMTSEV, P. Ya.

[Abstract] Diffraction of a plane electromagnetic wave by an ideally conducting solid cylinder of finite length is analyzed and asymptotic expressions are derived for the scattered field spreading about the specularly reflected ray. The field radiated by "edge" currents is determined from the solution to the diffraction problem according to the geometrical theory, obtained heuristically by the method of boundary waves. The field scattered by a cylinder base is determined in the physical optics approximation, and the field scattered by the lateral surface is determined on the basis of the vector potential representation. All these partial fields are added in order to yield the resultant field in the "boundary wave" approximation. The author thanks V. A. Borovik for helpful discussions. Figures 2; references 10: 4 Russian, 6 Western.
[260-2415]

UDC 621.371.25

GENERATION OF LOW-FREQUENCY ELECTROMAGNETIC OSCILLATIONS BY THE FIELD OF A POWERFUL RADIO WAVE IN THE IONOSPHERE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 276-292 manuscript received 15 Feb 80

AL'PEROVICH, L. S. and FEDOROV, Ye. N., Institute of Physics of the Earth, USSR Academy of Sciences

[Abstract] The problem of generating long-period geomagnetic variations in the field of a powerful modulated radio wave in the ionosphere is considered in detail. In the process it has previously been assumed that anomalous currents

originate because of a change of the collision rate. The present paper investigates two possible mechanisms for origination of anomalous currents: 1) Thermal--because of a change of the collision rate of the electrons with neutral conductors; and 2) Chemical--connected with a change of the kinetic coefficients in a powerful radio wave. The role is investigated of diffusion in the formation of an electromagnetic signal and an evaluation is made of the magnitude of possible artificial disturbances at various distances from the heated region. It is shown that the maximum effect of a powerful modulated radio wave in the ionosphere is achieved because of disturbance of the ionized recombination balance of the ionosphere plasma. Daytime and nighttime models of the ionosphere are presented. With a radiated power of $\cong 10^3$ kW, the maximum value of the perturbations of the magnetic field does not exceed $10^{-2} - 10^{-3}$by day and 10^{-1} by night under the center of the nonuniformity created. The authors thank A. K. Krestinin for valuable assistance in discussion of a number of problems considered in the work. Figures 6; tables 3; references 22: 15 Russian, 7 Foreign.
[264-6415]

UDC 621.396.677

DIFFRACTION OF ELECTROMAGNETIC PULSE BY A FINITE CIRCULAR CONE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 343-348 manuscript received 12 Feb 80

VASIL'YEV, Ye. N., GORELIKOV, A. I. and YEFIMOVA, I. G., Moscow Power Engineering Institute

[Abstract] In recent years much attention has been given to nonstationary problems of diffraction. This interest has been stimulated by the development of video pulse radar as well as by the fact that a nonstationary response makes it possible with comparative simplicity to select and analyze thoroughly the contributions to the reflected signal from individual parts of the scattering body. The present paper considers the nonstationary scattering of electromagnetic waves by a cone located in a homogeneous isotropic medium. The results of earlier work by Vasil'yev and Gorelikov (IZV.VUZOV: RADIOFIZIKA, 1980, 23, No 9, p 1092) are taken as a basis during analysis of diffraction at a cone of finite length. These earlier results were obtained for monochromatic oscillations in a wide frequency region with a subsequent Fourier transform. A series of calculations are performed which make it possible to investigate the nonstationary diffraction by the cone with respect to the following aspects: 1) Effect of duration of radio pulse on the form of the reflected signal; 2) Analysis of gradual transition from a pulse with a high-frequency filling to a video pulse; and 3) Effect of duration and form of video pulse on response. Figures 4; references 8: 2 Russian, 6 Western (in translation).
[264-6415]

ELECTRON AND ION DEVICES; EMISSION;
GAS-DISCHARGE AND ELECTRON-BEAM DEVICES

UDC 537.533.3

FOCUSING CHANNEL FORMED DURING SHAPING OF AN ELECTRON BEAM IN A TOROIDAL CENTRIFUGAL-ELECTROSTATIC DEFLECTION SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 424-434
manuscript received 24 Sep 80

BERNASHEVSKIY, G. A.

[Abstract] A new electron gun with a centrifugal-electrostatic deflection system has been developed which features a high perveance and compression ratio. Here the focusing in such a deflection system is analyzed theoretically, the simplest configuration being a toroidal capacitor segment. As the basis, coplanar trajectories of two electrons in the beam are considered and, with one of these trajectories assumed to be central, the focusing force on the other trajectory is calculated. The results reveal the formation of a focusing channel along whose sloping walls electrons climb because of inertia. The electrostatic field in the deflection system is calculated taking into account the space charge of the electron beam. The equivalent focusing electric field is zero at some value of the perveance and becomes negative as the perveance increases, which causes the electron beam to expand. The perveance increases with increasing thickness of the electron beam and with increasing length (angle) of the toroidal segment. The author thanks I. M. Bleyvas for supplying the toroidal capacitor and I. P. Polyanskaya for writing the computer program. Figures 10; references 5: 4 Russian, 1 Western (in translation).
[260-2415]

UDC 537.533.3

SHAPING OF AN ELECTRON BEAM BY AXISYMMETRIC ELECTRON-OPTICAL SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 416-423
manuscript received 26 Dec 79

GEYZLER, Ye. S., KUCHEROV, G. V. and TSYGANENKO, V. V.

[Abstract] Electron-optical systems for shaping of electron beams in such devices as cathode ray tubes with a semiconductor laser screen are considered, such systems operating with electron beam currents in the milliampere range. At this current level it becomes necessary to account for fifth-order aberrations. For design purposes, the radius of an electron beam and the appropriate aberration coefficients in the cross section which corresponds to optimum focusing are calculated for the model of an electron-optical system consisting of a cathode and an array of anodes with axisymmetric holes. The resultant electron beam is formed by superposition of elementary thermoelectron beams emitted by individual points of the cathode. Chromatic aberration, caused by a distribution of initial electron velocities at a single point of the cathode, is absent only in the case of zero initial velocity corresponding to an infinitesimally thin elementary electron beam. The trajectory along which such an elementary electron beam moves is a principal one and all electron beam parameters, including the current density distribution and electron energy distribution as well as the actual thermoelectron trajectories are referred to it. In this way the electron-optical characteristics of the system components can be accounted for in the design of an electron-optical system, with the source essentially distributed along the axis. References 13: 10 Russian, 3 Western (one in translation).
[260-2415]

UDC 621.373.431.4

SOME SPECIAL FEATURES OF THE OPERATION OF A MAGNETRON OSCILLATOR IN A CYCLOTRON RESONANCE MODE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 363-372 manuscript received 1 Nov 79, after consolidation 10 Jun 80

KRASNIKOV, M. Yu., Gor'kiy State University

[Abstract] The question of the effect of orbitral resonances on the operation of a magnetron oscillator in a synchronous mode is investigated. An analysis is also made of the effect of weakly-relativistic effects on the electron bunching in a magnetron with cyclotron resonance. The investigation shows the importance of taking account in a magnetron with cyclotron resonance of the effects of relativistic nonisochronism, particularly with small amplitudes of a high-frequency field. The effect of relativity hinders actuation of a magnetron because to initiate generation, a sufficiently large amplitude of a high-frequency field is necessary. The calculated efficiency proves to be below the theoretical value and amounts to 0.25. A substantial increase of the efficiency—up to 0.5—can be attained in a magnetron with a collector. Of the large number of double resonances in a magnetron, only one is significant—synchronous orbitral with $\omega/\Omega = n/2$. With $n = 1$, cyclotron resonance leads to a considerable increase in efficiency. An improvement of the interaction of electrons with a half-frequency field contributes to the fact that the interval of the decelerating phase coincides with the interval in which the radiuses of the electron orbit are decreased. With $n > 1$ this condition is not fulfilled. Furthermore, with an increase of n, the effect of the orbitral resonance on the synchronous interaction weakens to a considerable degree. The author thanks V. Ye. Nechayev for valuable comments. Figures 7; tables 3; references 7: 6 Russian, 1 Western.
[264-6415]

INSTRUMENTS, MEASURING DEVICES AND TESTERS, METHODS OF MEASURING, GENERAL EXPERIMENTAL TECHNIQUES

UDC: 535.317+621.397+681.7.01

POTENTIAL NOISE IMMUNITY OF OPTICAL INSTRUMENTS WITH MULTIPLEX CODING

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 81
pp 9-11 manuscript received 1 Mar 79

BUKHONIN, Yu. S.

[Abstract] The problem of determining the potential interference stability of optical instruments with multiplex coding, which refers to the process of linear transformation of optical images of objects or spectra to a uniform signal, is stated and solved after introducing a variety of conditions limiting the area of possible sets of carrier and weight functions. Under these conditions, assuming additive white noise, the potential noise tolerance of optical instruments with a unipolar signal is determined by an equation derived in this article and is achieved when a set of binary unipolar functions satisfying a certain property is utilized. Other equations define the interference stability and the parameters of the instruments with an arbitrary set of signals satisfying the conditions stated, e.g., sets of sine and cosine functions common in interference spectral instruments. References 8: 6 Russian, 2 Western.
[274-6508]

UDC: 535.681.45:778.27

PROJECTION INSTRUMENT FOR CHECKING GLASS FIBER BUNDLES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 81
pp 18-19 manuscript received 21 Mar 80

BURTSEV, Val. N., BURTSEV, V. N., VODOTYKA, N. S., TROITSKIY, N. S. and GONCHAROV, A. V.

[Abstract] An experimental model of a projection instrument designed for checking the quality of information light guides has been developed and manufactured. The device operates by projecting a uniform field of illumination into one end of the light guide, then projecting the light which emerges from

the other end of the light guide onto a screen. Damaged fibers in the light guide appear as dark spots on the screen. A negative photograph taken from the screen during testing of a light guide is presented, as well as a diagram and a photograph of the device itself. Figures 3.
[273-6508]

UDC: 535.854

IKAP-2 INTERFEROMETER FOR TESTING THE QUALITY OF ASTRONOMICAL MIRRORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80
pp 17-20 manuscript received 12 Jul 79

PURYAYEV, D. T. and GORSHKOV, V. A.

[Abstract] The IKAP-2 interferometer has been specially developed to test the shape of the surface of the second main mirror of a large azimuth telescope. The interferometer contains a universal compensator which transforms the spherical wavefront to a wavefront of any desired shape, assuring normal incidence of the light rays at the surface being tested. Differences from a standard interferometer include the fact that a special lens is used to assure that the wavefront striking the compensator is strictly spherical; the compensator consists of three lenses separated by air gaps; a Keppler system is used in the illuminating branch of the interferometer. The method of operation with the interferometer is described. A diagram and photograph of the interferometer are presented, as well as an interferogram produced with the interferometer of the surface of the second main mirror of a large azimuth telescope. The IKAP-2 interferometer has been used for manufacturing and certification testing of a 6-meter parabolic mirror, with interferograms analyzed both visually and by computer processing involving construction of a surface profile or topographic map. Figures 4; references 16: 11 Russian, 5 Western.
[256-6508]

UDC 621.317.36.029

INVESTIGATION OF THE CHARACTERISTICS OF A SCATTERING PROBE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 81 pp 57-59

VIL'KOTSKIY, M. A., GRINCHUK, A. P. and SITNIK, A. G.

[Abstract] The procedure for registering the amplitude-phase distribution of fields, based on discrimination of a signal scattered by a probe antenna makes it possible to simplify a scanning system and to reduce measurement error caused by the presence of a mobile line for transmission of a microwave signal between

the probe and the measuring equipment. Low-frequency modulation of the reflection factor of the probe is employed for discrimination of a signal scattered by a probe. Expressions are derived in the present paper in order to optimize basic parameters which characterize a scattering dipole probe charged by a controlled microwave diode. The values are presented of the probe parameters obtained from the results of an experiment. It is shown that on the basis of the investigations conducted, it is necessary to select the optimum dimensions of a scattering dipole probe, taking into account the parameters of specific measuring equipment and accepting a compromise solution which assures high effectiveness of the probe and a level of the noncontrolled scattering not more than that permissible. Evidently with the use of a matrix system of a large number of probes, its length must be less than the length of an individual probe and amounts to (0.35-0.45)λ. Figures 4; tables 1; references 5: 3 Russian, 2 Western.
[263-6415]

UDC 621.317.44:538.2

PRIMARY CONVERTERS FOR MEASUREMENT OF THE PARAMETERS OF MAGNETIC MATERIALS AT HIGH FREQUENCY

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 81 pp 61-62

SIMKIN, V. A. and SEROV, A. V.

[Abstract] In many respects measurements of the parameters of ferromagnetic substances at high frequencies depends on the technical and metrological characteristics of the primary converters employed. These converters are intended for conversion of the magnetic parameters μ' and $tg\delta_\mu$ of the specimens measured into an increase of the impedance. The authors present a brief survey of the parameters of such primary converters. A table presents the parameters of some of the primary converters considered, obtained during work with type Ye4-7 measurers at f = 1-35 MHz and with the VIMS-2A at f = 35-250 MHz. Certain developments in this field conducted at the Siberian State Scientific-Research Institute of Metrology (SNIIM) are described. Figures 2; tables 1; references 19: 18 Russian, 1 Western.
[263-6415]

UDC 621.317.74

FIRST CLASS MEASURING LINES P1-23, P1-26, P1-38

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 81 pp 56-57

GUTINA, E. M., KONDAKOV, Yu. V. and KOSTYUCHENKO, K. K.

[Abstract] First class measuring lines P1-23, P1-26, P1-38 are produced at the Siberian State Scientific-Research Institute of Metrology (SNIIM). Their design assures small natural reflections of the measuring channel and connectors, a high degree of constancy of the electrical couple of the transmitting channel with the indicating device, as well as a high precision of reproduction of the wave impedance of the measuring channel. The principal technical data on the lines and a set of supplies are listed in tables. Tables 2.
[263-6415]

UDC 621.382.8.029.7:536.5

AN ELECTRICAL THERMOMETER FOR MEASURING THE MEAN TEMPERATURE OF A LIGHT-BEAM CONDUIT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 435-439
manuscript received 26 Nov 79

[Abstract] Light beams in underground conduits with uniformly spaced corrective lenses or mirrors propagate mostly through air. Because the refractive index of air changes with the temperature and the pressure, the electrical length of such a conduit fluctuates as a result of diurnal and seasonal temperature and pressure variations (approximately by 1 m/km per 1°C). The problem with temperature measurements is whether the mean temperature of a long conduit can be replaced with the temperature at some conduit section, without loss of accuracy of theoretical predictions. In an earlier study this was found to be feasible in the case of small temperature variations, with fluctuations of the electrical length mainly caused by pressure variations. In this study larger temperature variations were considered, from -15 to +20°C. An electrical resistance thermometer with a high-current R-345 bridge circuit and an F-305 photoamplifier was used for the experiment. The probe in the form of a bifilar loop of a high-frequency cable with solid-air insulation, immune to variations of the magnetic field, was laid inside a 600 m long light-beam conduit with auxiliary electrical thermometers under the conduit shield and mercury thermometers buried in the ground close to the conduit. The maximum sensitivity of this special thermometer with a distributed probe was found to be $5 \cdot 10^{-3}$°C. Its readings agreed closely with those of a mercury thermometer at one section, within the accuracy of that control thermometer. Such probes, with a resistance of 50 ohms/km could be used for light-beam conduits up to 10 km long. Figures 4; references: 5 Russian.
[260-24[illegible]]

UDC: 681.2.083.8:535.8(088.8)

OPTOELECTRONIC MEASUREMENT TRANSDUCERS FOR LARGE ANGULAR AND LINEAR DISPLACEMENT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80 pp 16-17 manuscript received 20 Nov 79

AZIMOV, R. K. and SHIPULIN, Yu. G.

[Abstract] Known instruments designed for measurement of large distances (500 mm to 20 m) are complex in design, unreliable and uneconomical. Optoelectronic measurement instruments for large displacements and angles have the following advantages over other types: the moving elements can be freely transfered either inside or outside the light guides, the attenuation of light in which is used as a measure of the distance being gauged, without wear on the moving parts; AC or DC power can be used, because the impedance is resistive in the device; electrical and magnetic fields have practically no influence on the transducer; these devices are simple to design and to manufacture. A semicircular angle measurement transducer is illustrated, with a light source at each end, a transparent semicircular channel and a light sensor which can be moved along the semicircular channel. The angle to which the sensor is moved is measured by the difference in attenuation of the light from each end of the device due to the difference in path length. Recommendations are given with respect to the use of the transducers developed. Figures 3; references: 5 Russian.
[256-6508]

UDC 681.78:621.3.087.92

MEASUREMENT OF PULSE ENERGY OF OPTICAL RADIATION OVER A WIDE RANGE OF DURATIONS AND REPETITION FREQUENCIES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 81 pp 32-34

KIBOVSKIY, V. T., KLYCHEV, F. Kh., KUCHTEVICH, V. I. and RUBIN, Sh. A.

[Abstract] In photoelectric photometers intended for measurement of the energy of repetitive optical pulses over a wide range of durations and repetition frequencies, it is advisable to use the double integration signal of a photodetector in the measuring system in contrast to photometers which accomplish integration of the signal directly in the load circuit of the photodetector. During the design of photometers with autosynchronization, it is necessary to solve two contradictory problems: to assure measurement over a wide range of durations and repetition frequencies with simultaneous overlapping of a sufficiently wide band of pulse energies D_Q. The value $DQ = Q_{max}/Q_{min}$, where Q_{max}, Q_{min} are the largest and smallest measurable energies, depends on the range of duration selected, limited by the minimum and maximum duration of the radiation pulses.

The present paper considers the dependencies involved, and formulas are derived which make it possible optimally to break down the specified range of durations of the pulses into subranges and to compute the values of the principal time parameters of a two-channel measurer of the pulse energies of the radiation for each subrange. Figures 2; references: 4 Russian.
[263-6415]

QUANTUM ELECTRONICS

UDC: 621.375.82

BREAKAGE OF GLASS BY LASER RADIATION WHEN INCLUSIONS OF VARIOUS DIAMETERS ARE PRESENT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 80
pp 20-22 manuscript received 19 Apr 80

BUZHINSKIY, I. M. and POZDNYAKOV, A. Ye.

[Abstract] An attempt was made to establish experimentally the dangerous range of dimensions of absorbing microscopic inclusions for certain pulse lengths in a neodymium laser. Two laser installations with smooth pulses of two lengths ($1.2\cdot10^{-3}$ and $6\cdot10^{-5}$ s) were used. The inclusions were nontransparent and circular, contained in cylindrical specimens 30-mm in diameter and 50-mm in length, with the inclusions in the focal plane of a plano-convex lens. A helium-neon laser was the light source. The energy density was gradually increased by means of neutral density filters until characteristic disk-shaped cracks appeared in the glass. The threshold value of energy density was thus determined. It was found that for each pulse length there is a most dangerous diameter of inclusion: 100-300 micrometer for the millisecond pulse and 60-100 micrometer for pulses a few tens of microseconds in length, and 0.5-2 micrometer for pulses a few tens of nanoseconds in length. Figures 2; references 9: 8 Russian, 1 Western.
[256-6508]

UDC: 621.378.325

INFLUENCE OF TEMPERATURE ON WIDTH OF SPECTRUM OF GENERATION OF NEODYMIUM GLASS LASERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 81
pp 15-17 manuscript received 2 Jun 80

PONYAYEV, A. I., TOLSTOY, M. N. and SHAPOVALOV, V. N.

[Abstract] The influence of elevated temperatures on the parameters of generation of a laser with a neodymium glass active element and the significance of

various physical mechanisms responsible for the heating have been little studied. Earlier works have suggested that the long-wave shift and expansion of the lasing spectrum result from the influence of absorption from the $^4I_{11/2}$ level, the population of which is proportional to the concentration and increases exponentially with increasing temperature. To check this, the high temperature absorption spectra of active elements were measured. The effective gain was found to have a broad maximum displaced into the long-wave end of the spectrum from the luminescence maximum. Absorption from the $^4I_{11/2}$ level thus does play a role in selective losses in the resonator. The experiments showed that when lasing elements were heated to 100-300°C above room temperature, the formation of the spectral area of lasing is influenced by selective absorption from the thermally populated $^4I_{11/2}$ level. Figures 4; references: 6 Russian.
[274-6508]

RADARS, RADIONAVIGATION AIDS, DIRECTION FINDING, GYROS

UDC 621.371.332.3:519.22

STATISTICAL CHARACTERISTICS OF A SIGNAL REFLECTED BY AN OBJECT IN A RANDOMLY NONHOMOGENEOUS MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 299-304
manuscript received 11 Nov 79

SHLYAKHIN, V. M.

[Abstract] Reflection of a radar signal by an object in a randomly nonhomogeneous medium is considered and its statistical characteristics such as the effective scattering surface are described on the basis of their relation to the characteristics of that medium. It is possible to express the field scattered by an object in such a medium in terms of "complex phase" fluctuations. It is also possible to assume that the reflected harmonic signal is an additive mixture of two random signals whose amplitudes depend on the distortion characteristics and whose phases are independent with a uniform distribution. In the case of independent amplitude-phase fluctuations caused by the properties of the medium, it is the amplitude fluctuations, characterized by a dispersion dependent on the wavelength and the medium nonhomogeneity parameters, which have the dominant influence on the signal statistics. References: 6 Russian.
[260-2415]

UDC 621.391.268

USE OF THE WISHART DISTRIBUTION FOR EVALUATING THE EFFICIENCY OF ADAPTIVE MOVING-TARGET SELECTION SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 356-360
manuscript received 1 Aug 79

BARTENEV, V. G.

[Abstract] Adaptive moving-target selection systems are considered which operate under interference with a priori unknown correlation characteristics. It is expedient to reduce the adaptation problem to estimations of the modulus

and the argument of the interperiod correlation factor. In order to evaluate the efficiency of such a system, it is necessary to know the distribution of these estimates. Here the Wishart distribution of a complex positive-definite covariational matrix characterizing a complex Gaussian random process is used for this purpose. A recurrence relation is derived for the interference suppression factor in such an adaptive system consisting of an intraperiod subtractor with compensation of the Doppler interference phase. This factor is calculated for various values of the interperiod correlation factor and 1, 2, 4, 8 = range resolution elements or probing pulse carrier frequencies. Tables 2; references 4: 2 Russian, 2 Western (one in translation).
[260-2415]

UDC 621.396.67

STATISTICAL CHARACTERISTICS OF SIGNALS REFLECTED FROM EXTENDED OBJECTS NEAR A RADAR

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian No 3, Mar 81 pp 391-392 manuscript received 15 Nov 79, after completion 1 Aug 80

SHELUKHIN, O. I., Moscow Institute of Railroad Transport Engineers

[Abstract] The problem of detection of objects located close to a radar must be resolved with an allowance made for extended objects as well as the curvature of the front of the incident wave. As was mentioned in a 1977 paper by Shelukhin, the most promising radars for short-range operation are multichannel devices with space-time processing of signals. The present paper determines the space-time correlation function of signals reflected from extended objects in the case of multichannel structure of a radar. References: 3 Russian.
[264-6415]

UDC 621.396.96

RESOLUTION OF RADAR STATION WITH SYNTHESIZED APERTURE

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 27-29
manuscript received 16 Apr 80

KUNITSYN, V. Ye.

[Abstract] The author discusses the possibility of an increase of the azimuth resolution (AR) in the case of airborne radars with a synthesized aperture, used for such tasks as surveying the earth's surface. AR is dependent on the dimensions of the synthesized aperture, the wavelength, the distance from the synthesized aperture to the object, and the dimension of the radar antenna in azimuth. A method of processing is considered which makes it possible to improve resolution

of systems by "transillumination" of objects by acoustic waves, especially as in this case realization of an exterior reference source does not cause significant difficulties. References: 3 Russian.
[265-6415]

UDC 621.396.96:621.391.26

OPTIMUM SEARCH STRATEGY

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 29-32
manuscript received 20 Jan 80

BRANDIN, V. K. and SUDAKOV, V. F.

[Abstract] A number of works in the literature, devoted to formalization of the description of search procedure, are examined and the problem is considered of search for a target, the position of which is characterized by a one-dimensional probability density. The optimum distribution of search efforts and a law of movement are found. In the case of a specified distribution law of the power density of search efforts concentrated in the region of the distribution center, it is concluded that optimization of the strategy of target search reduces to the solution of a nonlinear integral equation. For the case considered a precise differential equation of optimum movement is obtained. References 6: 3 Russian, 3 Western.
[265-6415]

UDC 621.396.962.3

EVALUATION OF ERRORS OF A COMBINED DETERMINATION OF THE ANGULAR COORDINATES OF TWO SOURCES OF RADIATION BY A MULTICHANNEL RADAR

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 32-34
manuscript received after completion 11 Apr 80

TSAR'KOV, N. M. and MAKOVETSKIY, I. I.

[Abstract] During the process of using radars in the resolution element "range (speed)--azimuth--angle of elevation", signals from several targets (radiation sources) can simultaneously be found. The present paper is devoted to the problem of determining the errors of a combined measurement of the angular coordinates of two such targets by a multichannel radar. Expressions are obtained for the signal and fluctuation components of the equation of a two-target monopulse angle-measuring coordinator. It is possible to use these expressions in determining the errors of individual measurements of the angular coordinates of two signal sources which are found in one resolution element of a multichannel radar. Figures 1; references 7: 2 Russian, 5 Western (3 in translation).
[265-6415]

RECORDERS

UDC 681.84.083.8

AUTOMATION OF EVALUATION OF MAGNETIC RECORDING EQUIPMENT CHARACTERISTICS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 5-15
manuscript received after abridgement 18 Aug 80

VICHES, A. I.

[Abstract] It is shown that use of contemporary computers for metrological checking of magnetic recording equipment makes it possible considerably to simplify the processing, to increase productivity up to operation in real time and to accomplish a considerably more complete and involved evaluation of the equipment characteristics. All the metrological characteristics enumerated in the paper are obtained simultaneously in the process of one experiment. Twenty to 25 minutes of machine time are expended on their evaluation when a process is used with a speed of response on the order of 100,000 operations a second, and 10-12 min are expended on presentation of the results. The data presented show the possibility and advantage of automated methods of evaluating the metrological characteristics of magnetic recording equipment, which can be used for study, field inspections and periodic certification of this equipment. Figures 3; tables 4; references 11: 8 Russian, 3 Western (1 in translation).
[265-6415]

SEMICONDUCTORS AND DIELECTRICS, CRYSTALS IN GENERAL

UDC 621.373.5

EFFECT OF HIGHER HARMONIC COMPONENTS ON FREQUENCY OF CRYSTAL OSCILLATOR WITH S-TYPE NEGATRON

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 47-49
manuscript received 2 Jun 80

BORISENKO, A. L.

[Abstract] The author considers the effect of the higher harmonic components of a current on the frequency of crystal oscillators made with negatrons which have an S-shaped current-voltage characteristic. It is shown that correction for the frequency is several orders larger in comparison with the "3-point" type transistor circuits. The instability condition of the frequency is determined on the basis of variations of the spectral composition of the currents. In order to calculate the corrections shown in the paper, it is necessary to have values of the amplitudes of the currents through the crystal resonator and the magnitude of the reactivity connected with it. Because it is possible to represent any crystal oscillator by a complex impedance with a substantial negative part connected to the resonator, it is possible to extend the relations calculated in the paper to other transistor circuits of a crystal oscillator if the reactivity converted from the circuit of the series resonator also has the value of the harmonic of the current through the quartz (experimentally measured or calculated with respect to the harmonic of the transistor current). It is possible by circuit engineering solutions to attain a decrease of the "nonlinear" correction. It should be noted in this case that the magnitude and sign of the correction depend on the nature and magnitude of the reactivity connected in series with the quartz. Figures 1; references: 6 Russian.
[265-6415]

UDC 621.373.423

EFFECT OF REFLECTED SIGNAL ON GUNN OSCILLATOR

Moscow RADIOTEKHNIKA in Russian No 3, Mar 81 pp 23-26
manuscript received after completion 22 Sep 80

DEKIN, G. N., and TERESHCHENKO, A. F.

[Abstract] On a basis of the theory of nonlinear oscillations, the paper studies the optimum conditions of operation of an autodyne oscillator with employment of Gunn diodes affected by reflected signals, and calculates the sensitivity of the oscillator. Shortened equations are composed and solved. A formula for sensitivity is derived. The results obtained satisfactorily agree with experimental data obtained from the literature, from which it follows that the gain of the autodyne based on a Gunn diode lies in the limits (4-20) decibel which corresponds to a sensitivity of (16-10) V. Figures 4; references 6: 4 Russian, 2 Western.
[265-6415]

UDC 621.382.2.029.6

ANOMALIES IN THE VOLTAGE DEPENDENCE AND THE FREQUENCY DEPENDENCE OF THE EQUIVALENT-CIRCUIT PARAMETERS OF A SCHOTTKY-BARRIER DIODE IN THE MICROWAVE RANGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 2, Feb 81 pp 440-444
manuscript received 11 Jun 79

FIONIK, V. N. and MARKOVA, V. N.

[Abstract] There is some experimental evidence that the static current-voltage characteristic of the nonlinear resistance of a Schottky-barrier diode does not describe the relation between instantaneous currents and voltages according to the classical theory of nonlinear radio engineering devices. In view of this, an experimental study was made of the frequency dependence and the voltage dependence of both the equivalent resistance and capacitance characterizing various microwave Schottky-barrier diodes with a point contact. The test specimens, tens of each kind, included n-GaAs (single crystal or epitaxial layer), n-Si (epitaxial), and p-Si (single crystal or polycrystalline) devices with, respectively, Ni, Mo, and W chemically or electro-chemically deposited. The differential impedance was measured with the aid of coaxial lines and with the diode structures mounted in ceramic cases. The results reveal that both the resistance and the capacitance are essentially frequency independent so that the static current-voltage characteristic measured at a low frequency can be used for the design of microwave devices. The capacitance-voltage characteristic

can be described by the $C \propto (\frac{\varphi_0}{e} - V)^{-\gamma}$ relation at negative and small positive voltages (e denoting the electron charge and $0.3 < \gamma < 0.5$ depending on the impurity distribution in the semiconductor), the $C \propto V$ relation at higher positive voltages, and then $C \approx$ const at saturation. Because the slope of the resistance-voltage characteristic $\partial \log R / \partial V$ decreases with increasing voltage, the current-voltage characteristic can be regarded as an exponential one $I = I_s(e^{\alpha V} - 1)$ with $28 < \alpha < 36$ (V^{-1}) and I_s (A) constant. Figures 3; references: 7 Russian.
[260-2415]

VARIOUS MISCELLANEOUS ITEMS, INCLUDING THEORIES

UDC 534.87

CAUSTICS WITH AN ANOMALOUS PHASE SHIFT

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 2, Feb 81 pp 224-230 manuscript received 2 Jan 80

ORLOV, Yu. I., Moscow Institute of Power Engineering

[Abstract] The caustic in an anisotropic homogeneous medium is analyzed, with an additional phase shift beside the ordinary eikonal one appearing when the multiray beam has been modulated so as to make the second derivative of the field distribution function with respect to the initial beam coordinate positive. First the caustic of a plane amplitude-phase shield is considered, then its space-time analog: propagation of a frequency-modulated pulse through a medium with an arbitrary frequency dispersion law. In the case of a caustic with a nonsingular segment and such an anomalous phase shift, the near field is described by the Airy asymptotic expansion involving a collocation with the geometrical-optics approximation and the far field is obtained by using the Wentzel-Kramers-Brillouin asymptotic expansion of the Airy function. Figures 3; references 12: 10 Russian, 2 Western.
[261-2415]

UDC 538.566:519.25

WIDTH OF THE WAVE REFLECTION PATTERN AT A RANDOMLY ROUGH SURFACE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 2, Feb 81 pp 203-206 manuscript received 12 Aug 80

KHOMYAKOVA, L. V. and SHTAGER, Ye. A.

[Abstract] An experimental study was made of the wave reflection pattern with a variable sliding angle at a rough surface. Ultrasonic waves were reflected by the free surface of water in a pool, this surface made rough by a wind so as to produce a Gaussian distribution of ripple heights with a standard deviation of 1.5 mm, a time correlation interval of 0.2-0.3 s, and a space correlation

ellipse (minor semiaxis 30 mm long in the direction of ripple propagation and major semiaxis 110 mm along the direction of the ripple front). Readings at a carrier frequency of 3 MHz, corresponding to a 0.5 mm acoustic wavelength in water, were taken with a vertical rereflecting shield immersed and rotated in the water. An empirical expression is proposed for the mean pattern width as a function of the sliding angle which yields a close agreement with the theoretical relation at angles larger than 40° and with the experiment at angles within the 5-40° range. The discrepancy between theory and experiment at angles smaller than 5° is attributable to the presence of small ripples, disregarded in the Kirchhoff approximation of large ripples only. The authors thank A. I. Kalmykov for helpful discussion. Figures 3; references: 3 Russian.
[261-2415]

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